PATENT SPECIFICATION

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DRAWINGS ATTACHED

1 249 552

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(54) AXLES FOR TOY VEHICLES

(71) We, MATTEL, INC., a Corporation organised and existing under the laws of the State of Delaware, United States of America, of 5150 Rosecrans Avenue, Hawthorne, California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to toy vehicles and more particularly to axles means for use in such vehicles.

Toy car constructions which employ a pair of rigid axles snapped onto the bottom of the chassis of the car are well known. Wheels are rotatably mounted upon the ends of each of these axles. Such axles have a disadvantage that they do not permit resilient wheel mounting, and thus lack authenticity. Another disadvantage resides in the fact that the rigid axle must have a comparatively large diameter to prevent the axle from bending beyond its yield point when the car is subjected to a downward force during play. Such large diameters result in excessive frictional drag between the wheels and their associated axles.

Such prior art patents as United States patents Nos. 2,749,662; 3,009,287 and 3,280,500 suggest the mounting of such rigid axles in slots, the axles being permitted to deflect upwardly under the influence of springs in an attempt to gain a certain degree of authenticity. However, the constructions disclosed in these patents have the disadvantages that they are comparatively expensive to manufacture and assemble and that the axles are of a comparatively large diameter resulting in excessive frictional drag.

It is an object of the present invention to provide an improved axle for toy vehicles.

The present invention consists in an axle for a toy vehicle having wheels rotatably mounted on said axle, said axle having at least one pair of axle shaft portions substantially coaxial with each other when assembled in said toy and each having an outboard end receiving an associated one of said wheel, and an inboard end; and torsionally-resilient members connected to each of said inboard ends said axle shaft portions being movable with respect to said vehicle by torsional deformation of said members and means connecting said members to said vehicle. Drag on the wheels may be minimized by making the axle shaft portions of a much smaller diameter than is usually employed in toy cars. For example, the axle shaft portions may be made from a 20 thousandths, 0.8% carbon content, extra-high strain mandolin wire tinned and torsion straightened.

In our accompanying drawings:—

Figure 1 is a top plan view of a toy vehicle body employing one form of axle of the present invention;

Figure 2 is an enlarged, cross-sectional view taken along line 2—2 of Figure 1;

Figure 3 is a partial cross-sectional view taken along line 3—3 of Figure 1;

Figure 4 is an enlarged perspective view of the wheel-suspension and associated wheel hub forming a part of the vehicle shown in Figure 1; and

Figure 5 is an enlarged cross-sectional view of a wheel and axle assembly forming a part of the vehicle shown in Figure 1.

Referring again to the drawings, a toy vehicle constituting a presently preferred embodiment of the invention, generally designated 10, includes an undercarriage 11 having a frame 12 which is generally planar on its under-surface, as is shown in Figure 2. If desired, the underside can carry configuration which represents the bottom view of a conventional automobile. Upstanding flanges 14 are formed around the edge of frame 12 to strengthen it and to also conveniently serve as a means for interlocking with a toy car body (not shown) which may be mounted on the top of frame 12. Alternatively, frame 12 may form an integral part

[Price 25p]

of a car body. Front axle 16 and rear axle 18 are mounted on the top of frame 12. Front axle 16 carries front wheels 20 and 22 while rear axle 18 carries rear wheels 24 and 26.

Front and rear axles 16 and 18 are identical in their configuration and identical in their mounting upon frame 12. For purposes of convenience, only the rear axle 18 will be described in detail, it being understood that the description also applies to the front axle and its mounting.

Axle 18 is formed with a U-shaped centre portion 27 and axle shaft portions 28, 30 extending therefrom. The U-shaped centre portion 27 has a base 32 which is preferably substantially straight. Sides or torsionally-resilient members 34, 36 extend away from base 32, and preferably are directed somewhat toward each other at an acute angle, as is shown in Figure 1. Axle shaft portions 28, 30 are positioned on the ends of sides 34, 36, respectively, and extend laterally past the sides of frame 12. Side 36 preferably has a loop 37 formed therein to serve as a locating means upon assembly as is hereinafter described.

The entire rear axle 18 is made of a unitary structure, preferably by being made from a 20 thousandths 0.8% carbon content, extra-high strain mandolin wire which has been tinned and torsion straightened. Furthermore, in the unstressed condition, axle shaft portions 28, 30 are directed slightly downwardly from the plane defined by base 32. The general shape in the unstressed condition is shown in Figure 4. The amount of this deflection in the unstressed state from the reference plane of base 32, in conjunction with the resiliency and size of the material from which rear axle 18 is made, determines the amount of force which must be applied to the axle when it is in its mounted position, before it is deflected.

As is illustrated in Figures 1, 2 and 3, the top of frame 12 is generally planar, and extending up from the planar top surface are the peripheral flanges 14. In addition, transverse flanges 38, 39 and 40 extend upwardly from the plane of the top of frame 12. Flanges 38 and 40 are directed toward each other, but terminate short of each other. Flanges 38 and 40, in conjunction with flange 39, define spaces in which lie axle shaft portions 28 and 30. Thus these flanges restrain these axle shaft portions 28, 30 from substantial forward or rearward motion. In addition, a boss 42 lies between the inboard ends 43 of axle shaft portions 28, 30 to keep them separated, while the transverse flanges 38 and 40 terminate closely adjacent to the outer sides of sides 34 and 36. Thus, axle shaft portions 28, 30 are restrained from substantial axial motion. Hooks 44 and 46 are preferably integrally formed with the frame 12 and are positioned to extend over the top of sides 34 and 36 to retain base 32 against a wedge 47 on the top surface of frame 12. The raising of base 32 away from the general plane of the top surface of frame 12 stresses sides 34 and 36 so that the junctures of these sides with axle shaft portions 28, 30 lie against the top surface. Thus, upward loads upon the wheels causes rotation of the axle shaft portions 28, 30 about their inboard ends 43. Rotation at this point causes torsional deformation in the sides 34 and 36 and it is this torsional deformation that provides the principal amount of resilient deflection for the wheels.

Since the sides 34 and 36 are restrained against the planar top of frame 12, axle shaft portions 28, 30 are forced into a position wherein they are co-axial. Thus, the axle 18 is restrained so that the axle shaft portions 28, 30 cannot move to the unstressed position of Figure 4, but are maintained so that they cannot move below the planar position. By this means, the axle shaft portions are resiliently restrained in a co-axial position, as is illustrated in solid lines in Figure 2. When upward force is applied to the ends of the axle shaft portions, the pre-stress of the axle must be overcome before deflection occurs. This stress is such that under the ordinary weight of the toy car, no deflection occurs, but upon the application of further downward force, the outboard ends 48 of axle shaft portions 28, 30 can be resiliently displaced upward. The retention of sides 34 and 36 is such that during this displacement they continue to lie against the top of planar surface of frame 12 but twist in torsion. The amount of permissible displacement of the ends 48 of the axle shaft portions is such that the axle 18 is not over-stressed when deflections move the bottom of frame 12 into the same plane as the bottoms of the wheels, as shown in broken lines in Figure 2. Thus, the yield point of axle 18 is not exceeded even when the undercarriage is bottomed.

Since the axle should be correctly assembled onto the frame 10, in view of the unstressed shape of the axles, a pin 49 is formed on the top of frame 12. When the axle is correctly positioned on the frame, loop 37 embraces pin 49. If an attempt is made to insert the axle means in the incorrect position, side 34, which does not contain an engaging loop similar to loop 37 on side 36, would interfere with pin 49 and thus completion of assembly would be prohibited.

Referring to Figures 4 and 5, hubs 50 and 52 serve as wheel bearings and are respectively positioned upon the ends 48 of axle shaft portions 28, 30. Hubs 50 and 52 each have an opening therethrough to be rotatable on their respective axle shaft portions. Furthermore, hubs 50 and 52 are

preferably made of a synthetic polymer composition material of such nature that they are somewhat resilient and are slightly concave so that they formed with slight ridges 56 and 58 to retain the wheels in position thereon. Hubs 50 and 52 are maintained on their respective axle shaft portions by swaged knobs 60 and 62 formed on ends 48 thereof after the installation of the hubs.

As is seen in Figure 5, wheel 26 has a hub bore 64 therein. Preferably, wheel 26 is also made out of synthetic polymer composition material so that it is somewhat resilient. Hub bore 64 is of such diameter that, by resilient deflection, wheel 26 can be passes over and snapped over ridges 56, 58 which maintain wheel 26 in position. A simulated hub cap 66 is formed on the outside of wheel 26 and acts as an axle stop. Knob 62 engages upon the inside surface of the hub cap 56 to prevent the wheel and hub cap assembly from substantial inward motion upon the axle shaft portion 30. It is understood that the construction of each of the wheels 20, 22, 24 and 26 is as described with respect to Figure 5 with the possible exception of size and external shape of the wheel itself. This wheel construction permits the rapid assembly and firm retention of the wheels upon undercarriage 11.

The construction of the bearings is disclosed and claimed in U.K. Patent Application No. 12/69, Serial No. 1,249,551.

WHAT WE CLAIM IS:—

1. An axle for a toy vehicle having wheels rotatably mounted on said axle, said axle having at least one pair of axle shaft portions substantially coaxial with each other when assembled in said toy and each having an outboard end receiving an associated one of said wheels and an inboard end; torsionally-resilient members connected to each of said inboard ends, said axle shaft portions being movable with respect to said vehicle by torsional deformation of said members and means connecting said members to said vehicle.

2. An axle as claimed in Claim 1 wherein said axle shaft portions and said torsionally-resilient members lie in substantially the same plane when assembled in said toy.

3. An axle as claimed in Claim 1 or 2, wherein said axle shaft portions and said torsionally-resilient members are unitarily formed.

4. An axle as claimed in Claim 3, wherein said torsionally-resilient members include ends remote from said inboard ends which are connected together by a base portion to form a substantially U-shaped member therewith, said connecting means comprising a hook arrangement on said vehicle engaging said U-shaped member adjacent the base portion.

5. An axle as claimed in Claim 4, wherein the toy vehicle includes a frame having an upper surface with said hook arrangement being provided on said upper surface for retaining said U-shaped member in position thereon, a boss provided on said upper surface adjacent said hook arrangement for engaging said base portion to elevate said base portion above said upper surface and urge said inboard ends into engagement with said upper surface.

6. An axle as claimed in Claim 5, wherein said axle shaft portions lie away from a coaxial position before said U-shaped member is mounted on said upper surface and are moved to said coaxial position by engagement with said upper surface when said hook arrangement engages said U-shaped member with said base portion in engagement with said boss, whereby said torsionally resilient members are prestressed.

7. An axle as claimed in Claim 6 wherein said boss is a wedge and wherein said hook arrangement includes a separate hook engaging each of said torsionally-resilient members adjacent said wedge intermediate said base portion and said inboard ends.

8. An axle as claimed in Claim 7, wherein upstanding flanges are formed on said frame for caging said axle shaft portions, said axle shaft portions moving with respect to said vehicle by pivoting on said inboard ends, said flanges preventing substantial lateral displacement of said axle shaft portions during said movement.

9. An axle as claimed in Claim 8, including a loop formed on one of said torsionally-resilient members, and a pin provided on said upper surface at a predetermined location for engaging said loop when said U-shaped member is correctly positioned on said frame.

10. An axle as claimed in any one of Claims 1 to 9, which includes a bearing rotatably mounted on each of said outboard ends and affixed within a wheel.

11. An axle as claimed in Claim 10, wherein said bearing is disposed within a cavity in the wheel.

12. An axle as claimed in Claim 10 or 11, wherein each of said outboard ends is received in a bore centrally located in said bearing, said bore having a length greater than its diameter.

13. An axle as claimed in Claim 10, 11 or 12, wherein each of said outboard ends is adapted for retaining said bearing thereon.

14. An axle as claimed in any one of Claims 10 to 13, wherein said bearing is composed of a synthetic polymer.

15. An axle as claimed in any one of Claims 10 to 14, wherein the outer peripheral surface of said bearing is slightly concave to form ridges adapted for fric-

tional engagement with said wheel.

16. An axle as claimed in any one of Claims 10 to 15, wherein each of said axle shaft portions is approximately 0.02 inches in diameter.

17. An axle as claimed in Claim 1, substantially as described with reference to the accompanying drawings.

18. A toy vehicle having an axle as claimed in any one of Claims 1 to 17.

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1249552 COMPLETE SPECIFICATION
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Sheet 1

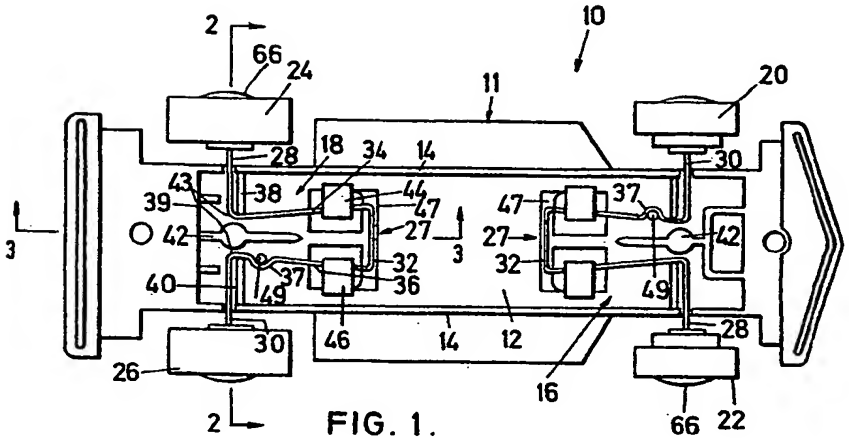

FIG. 1.

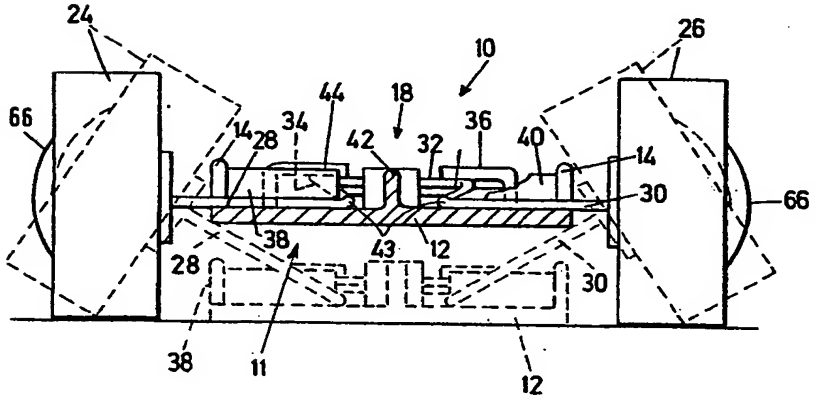

FIG. 2.

1249552 COMPLETE SPECIFICATION
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Sheet 2

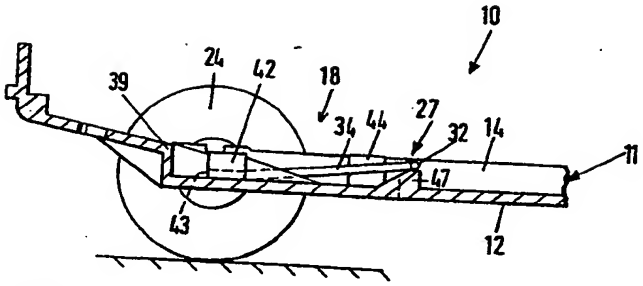

FIG. 3.

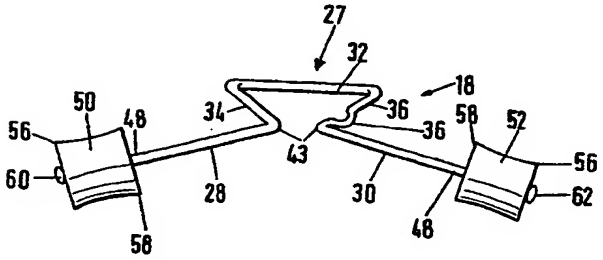

FIG. 4.

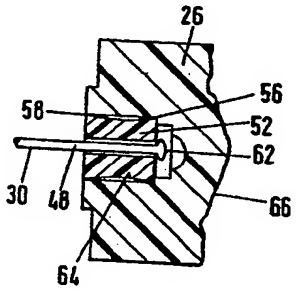

FIG. 5.